PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Combustion Chamber Linings

We, BROWN, BOVERI & COMPANY LIMITED, a Swiss Body Corporate, of Baden, Switzerland, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to combustion chambers for magnetohydrodynamic machines.

In the construction of walls of combustion chambers both metallic and ceramic materials are employed, according to the purpose and temperature range of the walls.

A metallic wall is chosen if either heat is to be drawn directly from flames (boiler) or high heat losses to the wall are not of disadvantage (gas turbines).

Conversely should the flame have to be guarded from too high radiation losses or should an adequate cooling of the wall be undesirable or cannot be guaranteed, then a ceramic wall may be well suited to practical application.

With very high temperatures and relatively high coefficients of emission for the flame, a very large portion of the heat generated is driven up to a cooled, metallic wall. The combustion does not then take place adiabatically and the flame temperature remains considerably below the theoretically attainable maximum stoichiometric value.

At the high temperatures attainable with stoichiometric mixtures, the danger is present that very highly insulated ceramic walls melt at the flame-side surface. This melting can progress so far that the strength of the walls is endangered.

With cyclone combustion chambers for pulverised-fuel burning, the combination of a water-cooled wall with a ceramic coating can be employed. At the same time the molten ash sticks to the cooling tubes and thus protects them from damage due to the fire. The disadvantage of this design is that practically only pulverised fuel can be burned since fuel-oil produces too little slag and the slag which is formed is in any case unsuitable.

In order to obtain the very high temperatures required in magnetohydrodynamic machines, it is important that the heat losses from the flame to the combustion chamber wall be kept as low as possible, otherwise, despite recuperation, the desired flame temperature will not be achieved.

The jump from flame temperature to the permissable operating temperature of the wall is none the less so large that significant heat-flow rates must be reckoned with. The heat incident on the wall can be extracted advantageously with the aid of water-cooling. The technical realisation of a ceramic wall which is both water-cooled and compact is fraught with considerable difficulties, especially due to thermal expansion.

The designs employed heretofore for combustion-chamber linings are thus unsuitable for magnetohydrodynamic machines.

The present invention has for its object the provision of a combustion chamber suitable for this application.

According to the present invention there is provided a combustion chamber for a magnetohydrodynamic machine, comprising a support member having wall portions defining a passage for the flow of cooling fluid, and a lining element consisting at least partially of ceramic material and supported by a portion of said support member extending away from said wall portions, the element being arranged on said support portion such that heat exchange between the element and the wall portions is substantially by radiation.

In order that the present invention may be well understood there will now be described two embodiments thereof, given by way of example only, reference being had to the accompanying drawing in which:—

Figure 1 shows a section taken along the

line I—I through part of a combustion chamber, schematically represented in Figure 2;

Figure 3 is a front view of a lining element; and

Figure 4 shows a cross-section through another design of combustion chamber.

Referring first to Figures 1 to 3, a combustion chamber 1 of a magnetohydrodynamic machine is lined with small plate-elements 2, made from a fire resisting material which is preferably ceramic or a corresponding material with ceramic additives. These lining-elements 3 are provided with a conical hole 3. On the side of the elements 2 facing away from combustion chamber 1 is situated a cooling system, a cooling tube 5 of which latter being depicted in Figures 1 and 2. In the inside of the tube 5 flows coolant 6. The tube 5 supports support pieces in the form of plugs 7 to which are attached the lining elements 2.

These elements 2 are each borne on a conical tightening ring 9 which is inserted in the element and is itself carried on the plug 7. A bearing ring 8 and nut 10 serve to hold the element in position. By this arrangement the lining elements are free to expand in all directions by which means the occurence of thermal stresses and the danger of breakage of the elements is avoided.

Each plug 7 can be either solid, as illustrated in Figure 1, or provided with passages for the circulation of coolant 6.

The plugs 7 are attached to the cooling tube 5 by soldering or welding.

The bearing ring 8 and the tightening ring 9 should preferably be made from ceramic material with a lower coefficient of thermal conductivity than that of the lining elements. In place of the nut 10, a closure-ring can be employed which is then soldered to plug 7.

In Figure 4 is represented a further constructional form of combustion chamber lining whereby each lining element 2 is fixed to a plug 15 driven into a cooling wall 16, the conically formed end-piece of the plug being received in a conical hole 3 provided in the lining element 2. With this arrangement, the lining element 2 is fixed in place on the plug with a bolt 18. The cooling wall 16 is provided with coolant channels 17.

The form of the cooling wall 16 conforms to the shape of combustion chamber 1. The cooling wall carries as many plugs 15 as are necessary to line the combustion chamber 1 with the lining elements 2.

As with the Figure 2 embodiment, adjacent lining elements 2 posses sufficient play in the cold condition to avoid coming into contact with each other when the combustion chamber in the operating condition.

The thickness and material of the plate-shaped lining elements 2 should be so chosen that the temperature of the side closest to the water-cooled wall 16 or, respectively, to the water-cooled cooling-tube 5, still remains so high that the heat from the lining elements can be given up through radiation to the cooled region.

It is also possible to employ larger elements and to support them with a number of cooled plugs.

The plugs 7 or, respectively, 15 are made from a very good heat-conducting material, e.g. copper.

The cooling of these lining elements takes place through radiation to the cooling tubes or, respectively, cooling walls so that these elements are free from direct contact-cooling, this then significantly reduces the risk of temperature stresses in these elements and their premature destruction.

By adopting a suitable form for the lining-elements and cooling walls it is possible to balance the heat transfer due to radiation so that the maximum permissible temperature as determined by the material employed in the lining elements can be maintained.

The embodiment described thus allow operation of the combustion chamber with minimum heat losses and high flame temperatures.

WHAT WE CLAIM IS:—

1. A combustion chamber for a magneto hydrodynamic machine, comprising a support member having wall portions defining a passage for the flow of cooling fluid, and a lining element consisting at least partially of ceramic material and supported by a portion of said support member extending away from said wall portions, the element being arranged on said support portion such that heat exchange between the element and the wall portions is substantially by radiation.

2. A chamber according to claim 1, wherein said lining element is mounted on said support portion by a member of a lower thermal conductivity than the lining element disposed between the support portion and the lining element.

3. A chamber according to claim 1 or claim 2, wherein said support portion is in the form of a plug secured in said wall portions.

4. A chamber according to claim 3, wherein said plug is solid.

5. A chamber according to claim 3, wherein said plug has passages for the flow of cooling fluid.

6. A chamber according to any one of the preceding claims wherein said support portion is of copper.

7. A chamber according to any one of claims 4 to 6, as appendant to claim 3, wherein said plug is soldered or welded to said wall portions.

8. A combustion chamber according to any of the preceding claims, wherein the lining element is held in place by means of a plurality of support portions.

9. A combustion chamber lining substan-

tially as herein described with reference to Figures 1, 2 and 3 or Figure 4 of the accompanying drawing.

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989996 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig.1

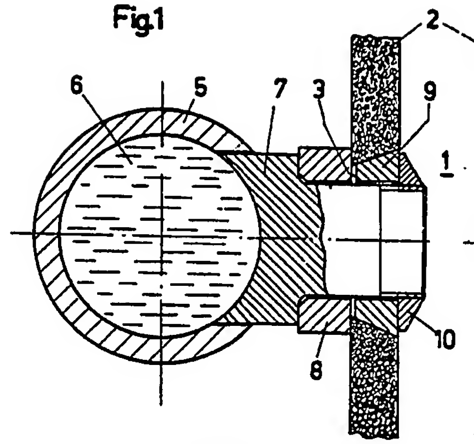

Fig. 3

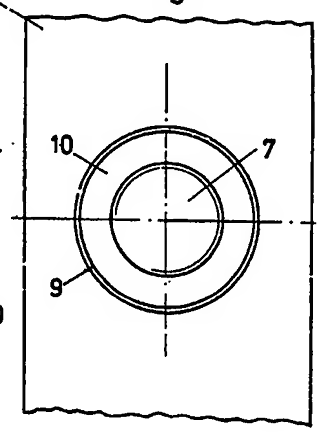

FIG.2

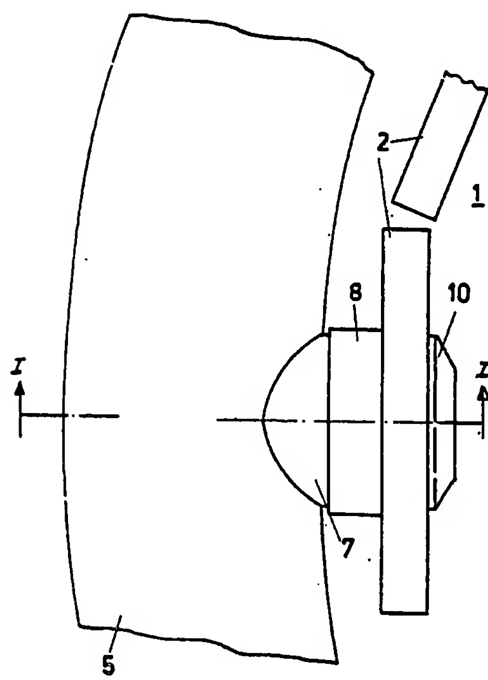

FIG.4